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(54) **LOGICAL OPERATION UNIT FOR PACKET PROCESSING**

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(57) **ABSTRACT**

An apparatus and method for performing logical operations
on information in the communications protocol stack, such
as the transport layer (L4) port numbers, characterizing a
received packet or frame of data in a data communications
device such as a router or switch. The results of the logical
operations, along with other packet/frame-identifying data,
are used to generate a more efficient lookup key. A content
addressable memory (CAM) lookup is used to determine the
action indicated by the rules defined by a rule-based routing
or switching scheme, such as an access control list (ACL).
The results of these logical operations extend the key space
and thus provide a finer-grained match between the original,
unextended input key and a rule action, thereby pointing to
a rule action precisely tailored to packet processing. The rule
can thus be applied with fewer CAM entries, providing the
versatility improvement and CAM cost reduction necessary
to keep up with the ever-increasing rule complexity require-
ments of advanced data communication and internetworking
systems. An embodiment utilizing asymmetrical processing
of packets, depending on whether the packet is inbound to
the data communications device or outbound from it, is also
disclosed. Furthermore, a ternary content-addressable
memory (TCAM) implementation is disclosed. Use of a
TCAM for ACL or other rule lookups further enhances the
efficiency of rule processing by providing a masking capa-
bility for each TCAM entry which can be used to provide an
additional level of flexibility for rule element checking.

37 Claims, 16 Drawing Sheets

